Eastw. 1933. A. & M. Seed Co. No data on collection. The species is related to *C. thyrsiflorus* Esch. The original collection was made at Lakeside, San Diego Co., at an elevation of 1,500 feet. 7. *C. dentatus* T. & G. 1932. Rowntree. 20 feet. Coastal plain just north of Monterey, near town of Marina. 8. *C. divaricatus* Nutt. 1933. C.F.E.S. 2,500 feet. Trail to Panorama, Devil Canyon Forest Experiment Station, San Bernardino National Forest. 9. *C. foliosus* Parry. 1932. Rowntree. 1,500 feet. Seed produced on plant at Carmel, transplanted from near Mt. Tamalpais, Marin Co. 10. *C. incanus* T. & G. 1931. Rowntree. 500 feet. Bear Creek Road, Santa Cruz Mts., just east of (town of) Boulder Creek. 11. *C. integerrimus* H. & A. 1931. Quick. 4,800 feet. River flat with other species of "hard-chaparral," South Fork of Stanislaus River, Tuolumne County. 12. *C. papillosus* T. & G. 1933. Rowntree. 250 feet. About five miles south of Santa Cruz, on road to Watsonville. 13. *C. purpureus* Jepson. 1932. Rowntree. 2,000 feet. Napa Range, east of Napa. 14. *C. rigidus* Nutt. 1930. Rowntree. 500 feet. Carmel Highlands, four miles south of Carmel on Coast Road. 15. *C. sorediatus* H. & A. 1930. Rowntree. 1,000 feet. Napa Range, five miles northeast of Napa, on road to Monticello. 16. *C. spinosus* Nutt. Sample II. 1933? A. & M. Seed Co. Collection data not known. See next. 17. *C. spinosus* Nutt. Sample I. 1933. Quick. 250 feet. University of California Campus at Berkeley. Horticultural. 18. *C. thyrsiflorus* Esch. 1933. Quick. 750 feet. John Garber Park, Berkeley Hills. 19. *C. velutinus* Dougl. 1932. Rowntree. 6,000 feet. East side of Sonora Pass in Sierras. 20. *C. verrucosus* Nutt. 1932. Rowntree. 250 feet. Point Loma, San Diego County.

Bureau of Entomology and Plant Quarantine,
U. S. Department of Agriculture, April, 1935.

A VEGETATION TYPE MAP OF CALIFORNIA

A. E. Wieslander

Those interested in the California flora will be glad to know that published units of a vegetation type map of California will soon be available for distribution. This map is being prepared as a part of a forest survey of California conducted by the United States Forest Service in cooperation with other federal and various state and county agencies. The survey embraces a total area of nearly seventy million acres and will cover the entire state exclusive of the deserts and the larger valleys devoted mainly to agriculture. When complete there will be a total of 220 map units. These units consist of the standard United States Geological Survey 15 and 30 minute topographic sheets upon which the vegetation types are shown in color and symbol legend. To date, field work has been completed on forty-eight units of which eight are now off the press and fourteen additional are in the process of publication.

The vegetation types are mapped in the field directly upon Geological Survey topographic quadrangles by direct observation and sketching from ridges, peaks, and other vantage points, supplemented by frequent sample-plot checks. The major types which are shown by color legend are further subdivided into pure and mixed stands in which species composition is indicated by symbols. A pure stand is defined as one in which a single species forms more than 80 per cent of the vegetation cover;

while a mixed stand is one in which neither of the two or more species composing it exceeds 80 per cent.

On the map, a pure stand is designated by the single important dominant. Ordinarily a mixed stand is designated by those dominants individually forming 20 per cent or more of the cover and they are listed in so far as practicable in order of relative abundance. However, in a composite formation, which is neither distinctly herbaceous, shrubby, nor arborescent, but a mosaic of two or more of these elements, this percentage is applied to each class of vegetation separately. For example, in a tree-shrub formation, the tree and shrub species forming 20 per cent or more of the aggregate area occupied respectively by trees and shrubs are designated, prior place in the designation being given to the trees. In this classification understory vegetation is not considered, but only those elements of vegetation cover visible from above as from an airplane. In shrub types, an estimate is made of the percentage of cover formed by the various species, but in tree types it is frequently easier to approximate this by tree counts. These percentages serve more accurately as guides for the major types and for pure subtypes which stand out in fairly bold relief, than for mixed stand subtypes. Where the latter merge from one subtype to another so gradually that there are no visible dividing lines, the sample plots serve as a basis for a delineation which gives at least close altitudinal and slope exposure relationships.

Each of the major types or plant associations represents an attempt to group subtypes having fairly similar fire hazard characteristics, and uses or qualities of economic importance. Thus, these broad plant associations in color legend serve to make the maps of ready use to engineers, foresters, and others charged with the management of so-called wild lands, while the more detailed subtype units provide the basic information on vegetation cover desired by the research worker in various fields such as botany, ecology, and forestry.

A great wealth of material in addition to the vegetation type map itself is being procured in this survey. Sample plots cross-sectioning all types mapped supply such details as species composition, stand density, size of trees and shrubs, and depth of leaf litter. On a supplementary map such information is shown as (1) occurrence of tree species not abundant enough or too restricted in area to be designated on the type map; (2) occurrence of shrub species of especial importance, the range of which would otherwise not be indicated either by the type map or the sample plots; and (3) visible boundaries of burned-over areas. Herbarium specimens are collected from every species recorded upon the map or in the sample plots of each quadrangle mapped. Photographs illustrative of various vegetation conditions are taken and are so referenced that they may be duplicated at a later time for the purpose of recording vegetational changes.

The Vegetation Type Map Herbarium, housed on the fifth floor of the University Herbarium in the Life Sciences Building, University of California, Berkeley, should be of increasing interest to California botanists. This collection now contains about 7,500 mounted specimens and it is expected that between 3,000 and 4,000 will be added yearly. It includes many plants in addition to those required for authenticating the maps and sample plots. Very complete field notes accompany each specimen, comprising information as to collector, date, elevation, location, also notes as to size and character of the plant, the slope exposure, the formation in which it grows, and the names of the more common associated species.

The primary purpose of the herbarium is to serve as a check upon field identifications, and to afford a permanent record of the plants collected in each quadrangle. Probably its greatest value, however, will lie in the wealth of material from all parts of the region, and in the detailed information, as to the range, habitat, and associated plants that will be available for each species. It is planned also to include in the herbarium characteristic photographs of many of the plants together with notes on their ecology and their economic importance as grazing or browse plants, or for erosion control.

The survey not only provides information about the present vegetation cover, but also discloses that in many localities its character has been profoundly changed since the advent of the white man. The most striking and significant of such changes are those representing a progressive deterioration from higher and more valuable to lower and less valuable types of vegetation as a result of such land abuse as destructive logging, accidental and wilful summer fires, the practice of annual burning in many foothill and mountain localities, and excessive grazing. As a consequence of such treatment, there have been extensive replacements of commercial timber stands by woodland, chaparral, or sagebrush; of big-cone spruce and Coulter pine by chaparral or woodland; of piñon by chaparral; of grasslands by chaparral or sagebrush; of chaparral by sagebrush.

A compilation of the information obtained in the western or foothill portion of El Dorado County affords an example of the character and extent of the change that has taken place along the western slopes of the Sierra Nevada. Of especial interest in this county is an area of about 162,000 acres, most of which lies between the 1,000-foot and 2,500-foot contour levels and adjacent to, but below, the present belt of yellow pine (*Pinus ponderosa*).[1] The type map shows that this area embraces about 30,000 acres of woodland, 45,000 acres of woodland-chaparral, 5,000 acres of chaparral, 43,000 acres of woodland-grass, 22,000

[1] "Ponderosa pine" is the name now officially recognized by the U. S. Forest Service for *Pinus ponderosa,* probably more widely known as "western yellow pine."

acres of grassland, and 17,000 acres of cultivated land including urban areas, and that most of the tree and shrub species occurring as important dominants in this area are mainly characteristic of the Upper Sonoran Life Zone. Study of the soil in conjunction with growth measurements of scattered second-growth individuals and groups of yellow pine show that this area is capable of growing excellent stands of this conifer. That old-growth stands of yellow pine formerly existed in this area and that lumbering operations had no small part in their disappearance is evidenced by such names as Sawmill Creek, Sawmill Ravine, Shingle Springs, as well as by known locations of early day sawmills including the famous Sutter Mill at Coloma, where the discovery of gold led to the mining rush of 1849.

Other interesting evidences of former pine forests were supplied by survivals of various sorts. Two cemeteries have preserved excellent stands of second-growth pine which would obviously have continued beyond these boundaries if not destroyed. In several localities boundary line fences between forest and non-forest cover coinciding with property line fences also indicate the artificial restriction of range. Still other evidence is provided by the general occurrence of California black oak, a species commonly associated with yellow pine and with much the same habitat requirements. The oak usually survives by sprouting when the pine succumbs to ax and fire.

From the facts accumulated in the survey of El Dorado County, the conclusion seemed warranted that, since the white man settled here, the yellow pine belt has retreated up the Sierra slopes an average distance of ten miles on a thirty mile front. This leaves a deforested area of 162,000 acres much of which has been invaded and occupied by tree and shrub species from non-forest areas below.

Obviously it is possible to present upon the published maps only a fraction of the information accumulated in this survey. Therefore, in order to increase their utility and interest, there is planned a further interpretation of the vegetation types by analysis of the supplementary sample plots and other data. This will be published as regional studies which, upon the completion of the survey, will be combined into a comprehensive whole. The first of these, for which the field survey has already been completed, will cover the Southern California region as embraced by the six counties of Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego. This study will attempt to correlate existing vegetation with various climatic and physical factors. The influence of man on the vegetation, with particular reference to the effect of fire, will be taken into account. The results to be expected from such a study might include among others the following:

1. A partial explanation of the present distribution of vegetation types and dominant species.

2. A better understanding of vegetation changes that have occurred in the past, those now in progress, or those to be expected to occur in the future.

3. Further contributions to our knowledge of the value of certain plants and vegetational types as indicators of particular soil and climatic conditions. These should have an important application in many fields, both in pure research and in applied fields such as game and land management.

4. Suggestions for future investigations and also a foundation for further research.

The projected study is in too preliminary a stage for present discussion other than to mention briefly two first steps which, in addition to the field work, are already under way. One of these is the preparation of maps of the Southern California region on a scale of one-quarter inch to one mile, each showing the distribution of one of the forty-two more important trees and shrubs. Both the dominant and scattered occurrence of the species are indicated on these maps, which are on tracing linen and will be superimposed on maps showing geologic formations, the various climatic factors and fire history. Thus, by these and other means, such as a statistical analysis of the sample plots, it is hoped to determine the rôle of the various factors controlling the distribution of these species. The other step is a systematic search of the literature for references to the character of the vegetation found by the early Spanish explorers and other pioneers in California, also to sawmill and logging operations, fires, and other destructive activities of man. Considerable progress has already been made in this compilation and from the information thus obtained it should be possible, in conjunction with evidence procured in the field work, as illustrated by the El Dorado County survey, to reconstruct a partial picture of former vegetation for comparison with that existing today.

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January 31, 1935.

RICHARD MORRIS HOLMAN

Richard Morris Holman was born in Allegheny, Pennsylvania, January 9, 1886, and died in Berkeley, California, April 23, 1935. His father and mother were both members of old New England families. His father, who was an attorney, died when the boy was quite young and the family moved to Palo Alto, California, where his secondary school education was completed. He entered Stanford University in 1903 and was graduated with the degree of Bachelor of Arts in 1907. It was during his college course that he became definitely committed to the study of botany as his life work. He served as assistant in the department at Stanford University and remained as acting instructor for one year. He was married to Esther Grace Hopkins in 1909,